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Extended Measurements of Photon Stimulated Desorption from a Copper Beam Chamber after Removal of Surface Oxide

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Beamline(s): U9A

Introduction: Photon Stimulated Desorption (PSD) was measured from a copper beam chamber after completely removing the vacuum surface oxide in order to reduce the PSD. Continuous measurements have been recorded for the chamber, over a year and a half of exposure, to determine long-term exposure effects. It is well known that PSD causes a pressure rise in accelerator and storage ring vacuum, which limits their performance.

Methods and Materials: The measurements of PSD and specular photon reflection were performed on NSLS beamline U9A at Brookhaven National Laboratory. For this experiment, a KEKB factory beam chamber from a previous experiment was chemically etched and chemically cleaned prior to installation on beamline U9A. Previous PSD measurements have shown that this chemical treatment removes any memory of prior exposure or conditioning. After installation, the copper chamber and end stop were vacuum baked to 250°C for more than a week to completely remove vacuum surface oxides. The chamber was exposed to more than 1x10E25 photons direct from the source having a critical energy of 595 eV and striking at an incident angle of 100 mrad. The major PSD yields for hydrogen, carbon monoxide, carbon dioxide, and methane are reported as a function of accumulated photon flux and preparation.

Results: The PSD yields for the copper chamber, after removal of the oxide, were found significantly reduced when compared to previous measurements at this laboratory and by those reported from other laboratories. The PSD component gases remained the same during the long exposure and all were significantly reduced. Carbon dioxide and methane were reduced much more than hydrogen and carbon monoxide. Specular photon reflection did not change significantly during the extended exposure. See figure 1.

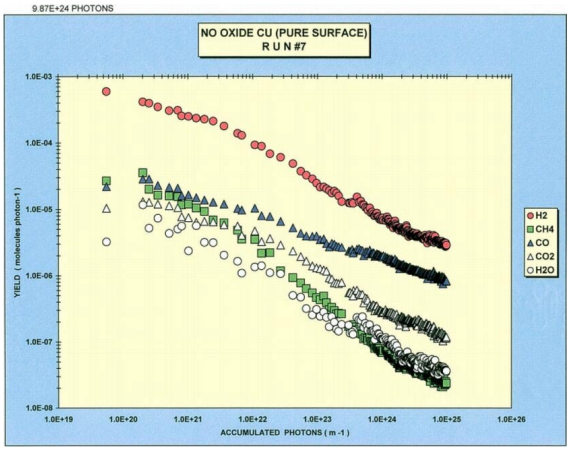

Figure 1. Major PSD gases are plotted as a function of accumulated photon flux